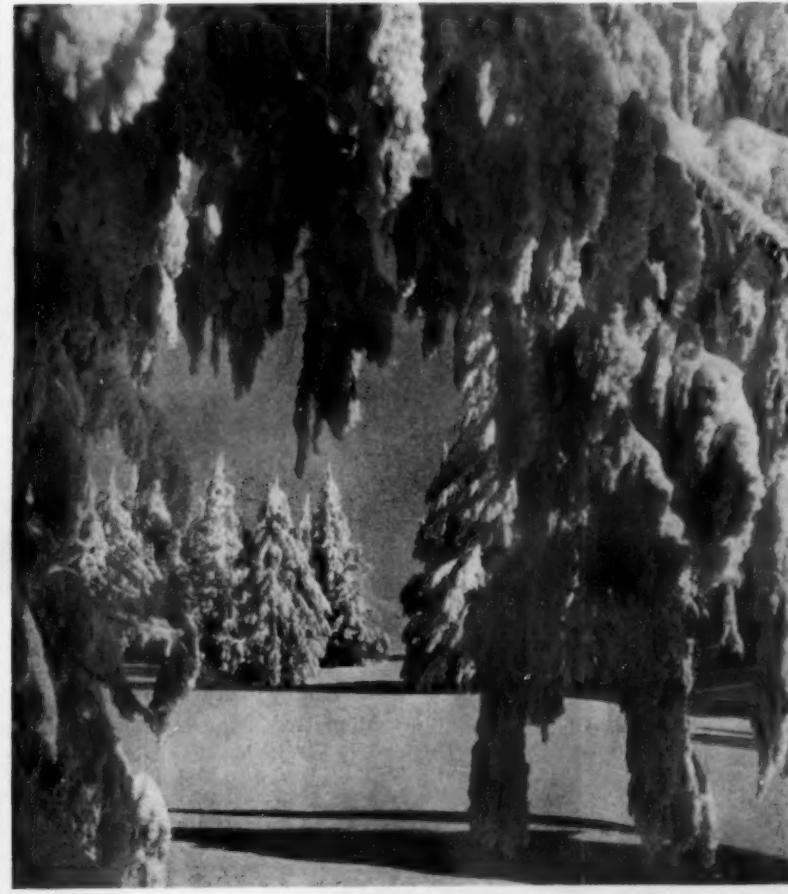


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SCIENCE REVIEW OF THE YEAR

SCIENCE NEWS LETTER

THE WEEKLY SUMMARY OF CURRENT SCIENCE •



DECEMBER 23, 1933

Trees Bearing Gifts

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Summary of Science



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ECOLOGY

TREES BEARING GIFTS

CHRISTMAS trees are always decked with tinsel frost and cotton snow, even in the South where children rarely or never see such wonders. Snow is inseparable from the idea of a Christmas tree; indeed, in the pre-Christian days in northern Europe the green of the tree, mysteriously defiant of the white winding-sheet of snow that carried all other leaves down in death, stood as a symbol of the hopes of the returning sun.

Medieval Christianity willingly adopted and adapted for its own uses this kindest of the old pagan observances, with very little change in the symbolism. Modern science, however, goes a step beyond, and finds in the white snow that lies beneath the trees and nestles among their branches not an image of death but the very material that will be most needed and used by the abundant life that will teem in the forests and over the wide fields beneath, when spring returns again. Snow, the best gift showered down by the gray winter heavens, is kept for us through the guardianship of the trees.

They hold out their arms and prevent

the wind from blowing it away. They stand against the climbing sun of early spring and keep him from melting it away too soon. The interlaced fingers of their roots hold the soil against the terrible eroding power of racing free water, even in the smallest streams. The litter of dead leaves and the spongy ground beneath soak up the water that trickles down and release it gradually through long thirsty weeks in summer, when bare rock has long since become a skeleton and even the prairie grasses are beggars under the hot scorn of the drought.

In this great service, little trees as well as great are effective guardians of the great gift of snow. Even the humble, too-often-despised proletariat bushes do their part of the work; for recent research in forestry has shown that brushland is almost as good as mature forest when it comes to holding snow and water, and in preventing erosion.

The beautiful photograph reproduced on the cover of this issue of SCIENCE NEWS LETTER was taken by Chief Ranger David H. Canfield, of Crater Lake National Park.

Science News Letter, December 23, 1933

Season's Greetings

SUPERIMPOSED upon the holiday spirit, the emotional reverence and the good resolutions of this time of the yearly cycle, there comes the opportunity of scientific evaluation. The physical necessity of changing our calendars from 1933 to 1934 gives an excuse for stock-taking and inventory.

Christmas week will bring numerous scientific meetings at which successful researches are reported, friendships are made and renewed and wells of inspiration are replenished.

As its contribution, Science Service has compiled a comprehensive review of some of the outstanding events and achievements of the closing year. This issue of the SCIENCE NEWS LETTER is devoted to this review of science.

In thus extending the season's greetings, the staff of Science Service desires to express its appreciation of the whole-hearted cooperation that has made effective its popularization of science. We greet the editors, scientists and laymen who participate through Science Service's newspaper services, the SCIENCE NEWS LETTER, and our other science popularization activities. With the assurance of their continued participation in our work, we rededicate our energies and ideals.

GENERAL SCIENCE

Science Marches On

Impressive Array of Achievements Gives Evidence of Abundant Activity in All Fields of Science During 1933

SCIENCE progressed steadily on all of its frontiers during 1933, despite the chaotic economic state of the world, hampering reductions in the support of scientific research and severe interference with science in some national areas.

Outstanding groups of science achievements were:

1. Experimental evidence for the conversion of energy into matter, confirmation of the positive electron (positron), continued exploration of cosmic rays, continued development of high voltage electricity and attacks upon the atom.

2. Determination of the properties of heavy or mass two hydrogen isotope (deuterium) and heavy water containing it, new processes for making available sulfur, phosphoric acid, and other chemical substances.

3. Demonstration of multiple hormones of the pituitary influencing bodily activity, discovery of an antidote to bichloride of mercury, the development of surgical technique for complete removal of a lung.

4. More evidence that modern man is as ancient as some of the more primitive extinct human races, unearthing of ruins of the Athenian Senate's meeting place, excavation of a Persian royal palace at Persepolis.

5. Stratosphere flights in U. S. and U. S. S. R., a record round-the-world solo flight, a number of long distance flights.

6. Renewed explorations of the polar regions, disastrous floods in China, the conclusion of meteorological research in the International Polar Year, the record of twenty tropical storms in U. S.

7. The beginning of a planned U. S. Agriculture, warfare against Dutch elm disease and grasshoppers.

8. Demonstration that the newborn can see objects and differentiate between degrees of illumination, development of a new physiological index to personality, discovery that apes are capable of the use of symbols.

Among the many important advances in science during 1933 were:

The greatest altitude yet attained by man is reported to have been reached by three Soviet fliers at 62,340 feet attained during a stratosphere ascent (unofficial record).

The world record for altitude was obtained for the United States by Lt. Commdr. T. G. W. Settle of the Navy and Maj. C. L. Fordney of the Marine Corps when they flew the stratosphere balloon "Century of Progress" to a height of 61,243 feet (official international record).

The first solo flight around the world from New York to Germany, to Siberia, to Alaska and back across the continent was accomplished by Wiley Post in just a few hours more than one week.

A world record for speed over a 3-kilometer course was established by the Italian, Francesco Agello, in a new type, 2-propeller seaplane when on April 10 he reached 423.822 miles per hour (682.078 km. p.h.) or over 7 miles a minute.

A new world record for altitude in an airplane was established by G. Lemoine, French flier, when he reached 44,819.418 feet (13,661 meters).

In a non-stop flight from Brooklyn, N. Y., to Rayack, Syria, two French fliers, M. Rossi and P. Codos, established a new world record for airline distance, covering 5,657.387 miles (9,104.700 kilometers).

A German flier, Kurt Schmidt, remained in the air in a glider for 36 hours, 35 minutes on August 3 and 4, establishing an international record for duration with return to point of departure.

An air fleet of 24 giant seaplanes under the command of General Italo Balbo made the first group crossing over the Atlantic from Italy to the Century of Progress Exposition in Chicago.

A new speed for cross-continent flying was set by Col. Roscoe Turner when he sped from Los Angeles to New York in 10 hours, 5 minutes, and 30 seconds, winning the Harmon Trophy.

A 5,341-mile non-stop flight from Cranwell, England, to Walvis Bay, S. W. Africa, was made by British aviators, Squadron Leader O. R. Gayford and Flight Lieut. G. E. Nichollets, in 57 hours, 25 minutes.

A flight between Australia and England in 6 days, 17 hours, 56 minutes was the feat accomplished by Charles Ulm on October 20.

The first transatlantic flight to terminate in the West Indies was made by two Spanish fliers, Capt. Mariano Barberan and Lt. Joaquin Collar, from Seville to Cuba in 39 hours and 55 minutes.

The international balloon race for the James Gordon Bennett Trophy was won by Captain Franciszek Hynek and Lt. Zbigniew Burzynsky of Poland, distance 846 miles.

A new speed for amphibians was attained when Alexander P. de Seversky reached 179.76 miles per hour over Roosevelt Field (not yet official).

The U. S. Navy airship Akron was wrecked April 3 with heavy loss of life off the Atlantic Coast during a "line storm."

In Germany, construction progressed on a new air liner, the LZ-129, which when done will have a length of 812 feet and a capacity of 7,070,000 cu. ft. making it the largest lighter-than-air craft in the world.

The U. S. Navy's airship Macon, sister ship to the ill-fated Akron and now the largest airship in the world, made her maiden flight on April 21.

A new giant plane reported capable of 208 miles an hour was put into transcontinental passenger service.

A wingless autogiro was developed in England.

Anthropology and Archaeology

Increasing indications were found, especially in Africa, that "modern" man is as ancient as some of the more primitive extinct human races.

Remains of *Eoanthropus*, the Dawn Man of Piltdown, are more nearly human than Neandertal man and probably not so old as investigators have thought, Dr. Hans Weinek of the Kaiser-Wilhelm Institute concluded after examining the original specimens.



READY TO TAKE OFF

Settle and Fordney are climbing into their stratosphere balloon for the flight on which they reached man's highest altitude, internationally recognized.

Peking Man had a brain distinctly human in type, showing a notable advance over that of Java Man, declared Dr. Eugene Dubois, Dutch scientist and discoverer of the latter species.

The Palestine race of Neandertaloid men, at first hailed as having a "modern" chin, may have had typically chinless individuals among them, recent examinations of their skulls tend to show.

Evidence that human beings lived in the Himalayas during the period of their final elevation was produced by Dr. Hellmut de Terra, Yale University.

The health of man is being undermined by the evolutionary tendency toward smaller jaws and dental degeneration, Dr. E. A. Hooton, Harvard University, warned.

Important data concerning extinct Pleistocene and recent period animals associated with human artifacts were disclosed by Edgar B. Howard of the University of Pennsylvania Museum, near Clovis, New Mexico.

A gallery of bronze portraits of the world's peoples, highest to most primitive types, was opened in the Field Museum, and pronounced by Sir Arthur Keith "the finest portraiture the world has yet seen."

Progress in clearing up the supposedly unsolvable problem of identifying the African home-lands of the American Negroes was reported by Dr. Mellville Herskovits, Northwestern University.

Efforts to rescue Indian ruins in the path of public engineering projects in the Southwest and the Tennessee Valley were initiated.

A thousand unemployed men, employed on a Federal Civil Works project in five states, began excavating Indian mounds and villages selected by the Smithsonian Institution as sites of promising importance.

Discovery of a small stone deeply buried in a partially cemented sand cliff, in Nebraska, was reported by Dr. Earl H. Bell and Dr. William Van Royen of the University of Nebraska, and the question was raised as to whether this indicates presence of man in America as far back as the last Ice Age.

Attempts to trace the prehistory of the Mississippi Valley won new success, as an early Mound Building culture discovered in Louisiana was linked by Frank M. Setzler of the National Museum with the famous Hopewell Mound Builders; while James Ford, a Mississippi archaeologist, traced the sequence from Hopewell through three more cultures ending in historic Tunica.

A charred timber found in an Indian dwelling in Arizona was cut about 660 A.D., the Museum of Northern Arizona reported, in setting a new "oldest date" in the ancient history of the United States.

Unusual prehistoric Indian artifacts were found by Dr. S. C. Dellinger excavating for the University of Arkansas in caves of the Ozark Mountains.

Trenching into the floor of a cave in Val Verde County, Texas, Prof. J. E. Pearce and A. T. Jackson of the University of Texas found an unidentified ancient Indian culture, perhaps a "melting pot" group blending ideas from various surrounding cultures.

Definite resemblances to the Big Bend Cave culture were established by F. M. Setzler of the U. S. National Museum along the southern end of the Pecos River in Texas.

Digging under downtown streets of Mexico City, Mexican government archaeologists

traced part of the plan of the great Aztec god-house of the ancient city.

In the cemetery of Monte Alban, Sr. Alfonso Caso of the Mexican National Museum found the tomb of a little girl, pronounced the most ancient burial yet found there and including pottery of a primitive Zapotec Indian type.

Finding proof that Indians in Mexico built pyramids to serve as astronomical timepieces was reported by Sr. Ignacio Marquina, Mexican government archaeologist.

Little known Indian tribes were studied in jungles of British Honduras and the Bay Islands off the coast, by Dr. W. D. Strong, Alan Paine, and Norman Haskell.

The division of Mayan ancient history into Old and New Empires was declared unjustifiable in the light of evidence now available, by Sr. Luis Rosado Vega who reported that Palenque's "Old Empire," ruins are no older than "New Empire" ruins in Yucatan.

An unprecedented example of arrangements at a Roman port overseas was discovered at the ruins of Richborough, England, where buildings proved to be storehouses of highly modern plan; the excavations were made by J. P. Bushe-Fox of the Society of Antiquaries of England.

Workmen digging foundations for a building discovered the main street of London of Roman days.

The third campaign of excavations in the Agora of Athens, directed by Prof. T. Leslie Shear of Princeton University, unearthed the meeting place of the Senate, a hitherto unknown library, and other structures.

Excavations at Corinth by Prof. Richard Stillwell of Princeton University revealed an enormous Roman building and earlier ruins showing that it had first been a Greek market place containing a double row of 66 shops.

Excavating the ruins of Phaestos, the Italian Archaeological Mission in Crete, led by Prof. Luigi Pernier, discovered in the ground plan of the palace a construction which he called the most ancient theater known.

Eugene Golomstok of the University of Pennsylvania Museum, working jointly with

Soviet scientists, excavated a "cave city" believed to have been Duros, ancient capital of the Goths in Crimea, finding thousands of relics from 1,400 to 3,500 years old.

Graves of blond Siberians of almost 1900 years ago, who were adorned in death with painted plaster masks that preserved, inside, exact facial features were discovered by Russian scientists exploring in the Minusinsk region of Siberia.

The founders of the great pageant of civilization in the Near East were not Semites nor Sumerians but an Alpine people from the north, was the conviction announced by Prof. E. A. Speiser, University of Pennsylvania, based on archaeological evidence.

Evidence that iron was used for weapons a thousand years earlier than had been supposed was found at Tell Asmar, Mesopotamia, by Dr. Henry Frankfort of the Oriental Institute.

Significant evidence that the Jewish exile from Palestine was not a captivity of the people as a whole, but merely a small part, was discovered by studies of pottery at Lachish, by the Wellcome Historical Medical Museum and the Colt Archaeological Expedition.

Excavating a Jewish synagogue dated 244 A.D. at Dura Europos, an expedition from Yale and the French Academy discovered paintings of Old Testament subjects showing unexpectedly that Christian art must have borrowed heavily from Jewish art in style, composition and subject matter.

Exploring Tal Arpachiyah, a site containing ten layers of settlement going back to perhaps 5000 B.C., the British Museum and the British School of Archaeology in Iraq found evidences of very early wheat cultivation, and religious and architectural features later appearing in Crete.

A country lost to history for twenty centuries was found in the Arabian peninsula by Prof. R. P. Dougherty, Yale University, through study of disconnected references in ancient writings.

A tablet bearing the names of 93 early Assyrian kings was discovered at Khorsabad by the Oriental Institute, thus filling in many



SPLENDORS OF PERSIAN PALACE REVEALED

Ruins of a royal palace at Persepolis were brought to light, offering the modern world a glimpse of Eastern magnificence of 2,500 years ago. Figures mounting the stairway represent ambassadors from twenty-two nations bearing tribute.

gaps in Assyrian history between 2200 B.C. and 730 B.C.

Dr. Ernest Herzfeld, excavating for the Oriental Institute at the ruins of Persepolis, Persia, brought to light the sculptured walls and stairway of a royal palace of great magnificence, about 2,500 years old.

China's civilization was pronounced younger than that of Egypt and Mesopotamia, by C. W. Bishop of the Freer Gallery, who reported that China's Bronze Age began about 2000 B.C.

Four royal Nubian tombs, intact with the magnificent burials of kings, queens and attendants, were found in Upper Egypt by the Egyptian Government Department of Antiquities.

One of the important Egyptian Neolithic settlements, at Maadi, a suburb of Cairo, was excavated by Profs. Oswald Menghin and Mustafa Amer for the Egyptian University, and valuable information regarding pre-dynastic life and history was obtained.

Continuing excavations at Hermopolis, Egypt, Prof. Gunther Roeder of the Pelizeus Museum in Germany discovered remains of a temple with a pylon, built about 2000 B.C., and pointing, perhaps, to invention of the familiar type of entrance at that time.

Applying ultraviolet rays to badly worn Egyptian monuments, an expedition from the Boston Museum of Fine Arts found it possible to reveal hidden inscriptions.

Using infrared photography, the British Museum restored to readable condition early Egyptian texts on leather and discolored Greek texts on papyrus.

Astronomy

A great unpredicted meteor shower, probably one of the major meteoric displays of all history, was seen from Europe on October 9 and was linked with the Giacobini-Zinner comet, a periodic visitor to the sun's neighborhood.

Nova Ophiuchi No. 3 flashed in August to brilliance never before recorded for this unusual "new star," discovered by L. C. Peltier, Delphos, Ohio, amateur.

A large white spot suddenly appeared in August on the equator of Saturn.

A minimum in the sunspot cycle occurred in the fall, with the first spot of the new cycle observed at Mt. Wilson Observatory on October 10.

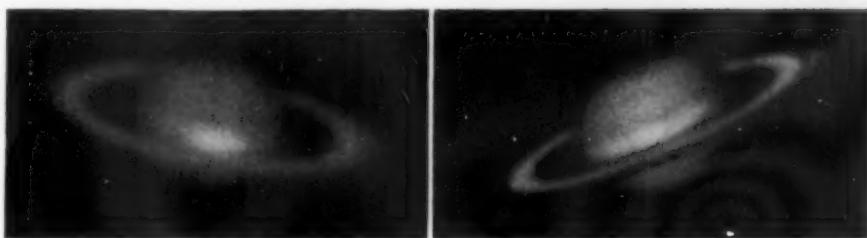
A rare eclipse, a star hidden by Jupiter, occurred April 21.

The possibility that the universe was not created at a definite time in the past and that it will not stagnate and suffer a heat-death in the future was opened by extension of thermodynamics to relativity by Prof. Richard C. Tolman, California Institute of Technology.

Dark matter between the stars may be more plentiful than the shining substance of the stars themselves, Prof. Joel Stebbins, University of Wisconsin's Washburn Observatory, reported.

The Milky Way galaxy in which the sun is a star is perhaps not of unusual size as previously supposed, Dr. Joel Stebbins, Washburn Observatory, concluded after experiments upon interstellar dark matter with photoelectric apparatus attached to the 100-inch Mt. Wilson telescope.

The Milky Way system of stars rotates like



SPOTTED AND UNSPOTTED

The great white spot which broke out on Saturn is shown in the picture on the left, taken by Dr. E. C. Slipher on Aug. 9 at Lowell Observatory, Flagstaff, Ariz. The other picture, taken by the late Dr. Lowell on Nov. 4, 1909, represents the equatorial belt of Saturn as it usually appears.

a vast celestial pinwheel requiring 240,000,000 years for a revolution, Prof. Alfred H. Joy, Mt. Wilson Observatory, concluded.

A faint light in the night sky, called "cosmic radiation of the night sky" (not to be confused with penetrating cosmic radiation), was discovered by Dr. V. M. Slipher, Lowell Observatory, and attributed to a faint sun-irradiated luminescence of the earth's atmosphere.

Detection of ether drift, indicating that the sun and its planets are moving southward in the direction of the famous Great Magellanic cloud of stars at 450,000 miles per hour, was reported by Dr. Dayton C. Miller, Case School of Applied Science.

Super-galaxies, which are groups of "island universe" galaxies like our Milky Way, are often found in pairs, Dr. Harlow Shapley, Harvard Observatory reported.

The distant galaxies are irregularly distributed in space as a result of some evolutionary process in the universe, Dr. Harlow Shapley, Harvard Observatory, suggested.

The earth and the moon were born out of the parent spiral nebula that fathered the sun and other stars of the Milky Way, Prof. Harlow Shapley, Harvard Observatory, suggested.

Gegenschein, or counterglow in the dark night sky due to reflection of sunlight from minute particles in space, was measured through Yerkes Observatory's 40-inch refractor with a photoelectric cell.

A luminous gaseous envelope extending out into space from the earth, or the earth's corona, was demonstrated through aurora researches by Prof. Lars Viegard of University of Oslo, Norway.

Most of the earth's atmosphere was lost shortly after its birth, Prof. Henry Norris Russell of Princeton and Prof. Donald H. Menzel of Harvard, concluded from a study of cosmic and terrestrial abundances of elements.

Local radio reception will be helped by the increasing unspotting which will follow the sunspot minimum, Dr. Harlan T. Stetson, Perkins Observatory, predicted, and few sunspots during 1932 and 1933 aided long distance radio reception.

A limit of 100,000,000 degrees Centigrade for the internal heat of the sun was suggested in computations by Dr. Edwin McMillan, University of California, based on the relative amounts of lithium isotopes in the sun.

A new solar radiation observatory was established by the Smithsonian Institution on the summit of Mount St. Katherine on the Sinai peninsula.

Lower solar radiation values for the next two years were forecast by Dr. C. G. Abbot, secretary of the Smithsonian Institution.

The hypothetical sun element, coronium, was tentatively identified with the common element, oxygen, by Dr. D. H. Menzel, Harvard Observatory, and Dr. J. C. Boyce, Massachusetts Institute of Technology.

A combination of television transmitter with spectrohelioscope made by Dr. A. H. Rosenthal, Potsdam, Germany, made it possible to watch the sun through the medium of invisible radiation.

Solar prominences, great hydrogen flames shot out hundreds of thousands of miles from the sun, were photographed directly by M. B. Lyot, Meudon Observatory, France, without waiting for an eclipse or using a spectroscope.

The eclipsed moon is a thousandth as bright as the full moon, Dr. R. L. Waterfield, British astronomer, determined.

Conditions on Mars favor the existence of life on that planet, Dr. V. M. Slipher of Lowell Observatory, Ariz., concluded.

Discovery that the companion star to Sirius is three times as bright as previously estimated, caused a questioning of relativity and the Einstein "red shift" relationship by Dr. A. N. Vyssotsky, University of Virginia.

The building up of other heavier atoms out of hydrogen stokes the internal heat of the stars, Prof. Henry Norris Russell, Princeton astronomer, suggested.

Photoelectric cells were applied to the measurement of the brightness of stars at Mt. Wilson and Washburn Observatories.

A variable star that changes its brightness 16 times a day was discovered at Yale's Johannesburg station.

One star in every four may consist of two suns swinging around a common center of gravity, a five-year survey of the southern sky from the Michigan Observatory, Bloemfontein, South Africa, indicated.

A sudden brightening of the periodic comet Schwassmann-Wachmann was observed in January.

A new comet was discovered in February by Leslie C. Peltier, a Delphos, Ohio, amateur astronomer.

A new comet was discovered in July by Prof. R. Carrasco Garrorena, Madrid Astronomical Observatory.

A new comet was discovered in October by Dr. Fred L. Whipple, Harvard Observatory.

Wolf's comet, with a period of seven years, was observed on its scheduled return.

Giacobini's comet, a periodic visitor, returned on schedule.

Periodic Pons-Winnecke comet made its first scheduled return since 1927.

The lost asteroid Zerlina was rediscovered by Prof. E. F. Carpenter, Steward Observatory.

Building of McDonald Observatory on Mt. Locke, Texas, with its 80-inch reflecting telescope, operated jointly by the University of Texas and the University of Chicago, was begun.

The Fels Planetarium of the Franklin Institute, Philadelphia, opened as America's second "synthetic sky" projection theater.

The Society for Research on Meteorites was organized.

An unusual meteor was seen in southwestern states on March 24.

"Bays" of the Carolinas, mysterious ridge-surrounded, crater-like, elliptical depressions in the sandy coastal plain, were attributed to the collision of the earth with a comet or meteorite shower, but some geologists hold they were created by wind and water.

The Harvard Observatory 61-inch reflecting telescope was completed and set in operation at the Oak Ridge station, 25 miles from Cambridge, Mass.

Neon was placed among the most abundant elements, despite its terrestrial scarcity, by the identification of several emission lines in novae and nebulae spectra, with the elements fluorine and neon by Dr. Joseph C. Boyce, Massachusetts Institute of Technology, Dr. Donald H. Menzel and Dr. Cecilia H. Payne, Harvard Observatory, and the identification of neon absorption lines in the spectra of certain hot stars by Dr. Menzel and Roy K. Marshall, University of Michigan.

By assuming that stellar atmospheres consist predominantly of hydrogen, Prof. Henry Norris Russell, Princeton University, reconciled theoretical discrepancies in relative intensities of lines in spectra of stars of different temperatures.

Biology

A revolutionary program of concerted crop-area limitation, the first step in a planned American agriculture, was initiated by Secretary of Agriculture Wallace; further developments of the plan involve a general agricultural re-settlement of the country, with a withdrawal of "marginal lands" from crop production and their restoration to the public domain.

Scientists of the U. S. Department of Agriculture planned for new crops, non-competitive with those of older cultivated areas, for the new lands to be opened up by Boulder Dam and other irrigation projects in the Southwest.

Reforestation and the improvement of existing forests were carried out on a large scale by the Civilian Conservation Corps, organized by recruiting many thousands of unemployed young men.

The John B. Pierce Laboratory of Hygiene, under the direction of Dr. C. E. A. Winslow, was completed and opened in New Haven in affiliation with the Department of Public Health, Yale School of Medicine.

A "new anthropogeny," tracing the evolution of man in 25 stages from the lowest fishes to his present state, was proposed by Prof. W. K. Gregory, Columbia University.

The growth of nerve fibers in living tissue was demonstrated in motion pictures by Prof. Carl C. Speidel, University of Virginia.

Supposed "radiations" from the human body that kill plants are really a chemical substance (oxycholesterol), Prof. Otto Rahn, Cornell University, declared.

Eyes of newborn infants were found to have many colors, by Dr. W. C. Beasley, Johns Hopkins University, thus upsetting the ancient notion that all newborn babies' eyes are blue.

A new mathematical method designed to chart and predict the course of evolution of a given hereditary line was demonstrated by Dr. Harry H. Laughlin, Carnegie Institution of Washington.

The external poison glands of toads secrete epinephrine, cholesterol and ergosterol, it was found by Drs. K. K. Chen, A. L. Chen and H. Jensen, of Indianapolis and Baltimore.

True mutational changes in mice through the use of alcohol and other poisons were claimed by Dr. Agnes Bluhm, Kaiser-Wilhelm Institute for Biology, Berlin.

The volume of the gene, the "atom" of heredity, was estimated as one quintillionth of a cubic centimeter, by Drs. J. W. Gowen and E. H. Gay, Rockefeller Institute for Medical Research.

The Edgerton-Germeshausen ultra-fast motion picture camera, at Massachusetts Institute of Technology, was used in biological studies.

A gorilla foetus in an early stage was acquired by the Western Reserve School of Medicine.

Water can be made poisonous to protozoa by treating it with X-rays, three Stanford University scientists discovered.

Electrical changes accompanying nerve action are less abrupt in the brain than in the nerves, Prof. E. D. Adrian, Cambridge University, reported to the British Association for the Advancement of Science.

A new centrifuge microscope, permitting the simultaneous examination of different objects while they are being whirled rapidly, was invented by Prof. E. Newton Harvey, Princeton University.

Valuable contributions were made to the problem of vocal sounds by infra-human animals, by W. Craig for the wood peewee, and by O. J. Murie and W. M. Rush for elk.

That the stimulus of light through the eyes has definite effects on the pigment of the chromatophores in the skin of some fishes was shown more definitely than ever before by Dr. F. B. Sumner, Scripps Institution.

Whole embryos of rats and rabbits, as well as parts of their bodies, were kept alive for short periods in glass vessels, in several different laboratories.

Five fossil teeth from an extinct saw-fish's saw collected by Charles Darwin, together with an autographed note, were placed on public exhibition in the Museum of Comparative Zoology, Cambridge, Mass.

Caterpillars respond to sound wavelengths audible to human ears, Dr. D. E. Minnich, University of Minnesota, reported.

A joint oceanographic expedition of Yale University and the Woods Hole Oceanographic Institution worked in the Caribbean, on the research ship "Atlantis."

Unseasonable weather—too wet and cold in the spring, droughty afterwards—caused



U. S. Forest Service

THREATENED

The beautiful elm, widely used as a shade tree in this country, is endangered by an outbreak of Dutch elm disease.

late planting of much of the corn crop, and a short yield.

The American wheat crop was the smallest in 30 years.

Barley found in a 7,000-year-old Egyptian tomb was shown to be identical with the barley grown in modern Egypt.

A banana variety resistant to the destructive Panama disease was developed in Trinidad.

A ten-year research program aiming at the adaptation of temperate-climate fruits to cultivation in the West Indies was announced.

The American Ornithologists' Union celebrated its fiftieth anniversary.

Development of a pronghorn antelope preserve in Petrified Forest National Monument was undertaken by the Office of National Parks, Monuments and Reservations.

A bird refuge was established on the Dungeness Promontory, in England, through the heroic sacrifice of the whole life savings of a retired teacher, R. B. Burrowes.

International protection for European moose was initiated at a conference in Berlin in July.

Two hundred young storks were transported from East Prussia to lower Westphalia and there released, to see whether they would change their migration route.

An international conference on the conservation of African game was held in London early in November.

Fourteen thousand nine hundred and twenty-eight interceptions of harmful insects, and 6,262 interceptions of plant diseases, were made by U. S. Department of Agriculture workers on plants, fruits, etc., being brought into this country.

Grasshoppers were numerous and destructive in the West; ten Grain Belt states and three Canadian provinces planned a cooperative campaign against this plague.

International warfare on locusts was organized, with headquarters in London.

A technique for vaccinating young turkeys against blackhead disease was developed by Dr. E. E. Tyzzer of the Harvard Medical School.

Eel grass, important as duck food and as preventive of shore erosion, has died out through the whole North Atlantic region.

There was an outbreak of screwworm fly, major cattle pest, in Southeastern states.

Immense swarms of mosquitoes caused live-stock losses in Florida.

An eland-cow hybrid calf was born in South Africa.

A new National Monument, comprising 392 square miles, was set aside on the Colorado River a few miles downstream from Grand Canyon National Park.

The northern limit of trees in Alaska is moving northward, studies by Prof. Robert F. Griggs of George Washington University indicate.

Dutch elm disease, a very destructive malady of elm trees, was discovered in the New York Harbor region; measures against it include a strict quarantine on foreign elm logs imported for use in furniture making.

Reforestation of areas denuded since the Conquest was undertaken in Mexico.

The Civilian Conservation Corps eradicated wild currant and gooseberry bushes, carriers of the white pine blister rust fungus, from a large area in the Northwest.

Partial surgical removal of the stored food of cantaloup seedlings led to an increase in relative duration of life of from three to six times, and also to greatly increased relative growth, in experiments performed by Dr. Raymond Pearl and his associates at the Johns Hopkins University.

Although ordinary nitrifying bacteria will not live in sea water, the nitrate content of sea water increases under sunlight, C. E. ZoBell of the Scripps Institution of Oceanography reported.

Stems and leaves of plants were forced to form new roots by treating them with carbon monoxide, by scientists at the Boyce Thompson Institute, Yonkers, N. Y.

Cacti, hitherto considered immune to plant tumors, were successfully inoculated by Dr. Michael Levine; but only the giant tree cactus proved susceptible.

Roots do not need to be alive to take in water, Dr. Paul J. Kramer, Duke University, discovered.

Experiments showing stimulation of plant growth by moderate doses of X-rays were reported by Prof. Charles A. Shull, University of Chicago.

Mutations arise more often in plants grown from old seeds than in those from new, Prof. J. L. Cartledge of the University of Pittsburgh and Dr. A. F. Blakeslee, Station for Experimental Evolution, Cold Spring Harbor, N. Y., discovered.

Mutations were induced in plants by heating seeds, Prof. M. Navashin and P. Shkvarnikov of Moscow reported.

Evidence that plants can make direct use of complex nitrogenous compounds was presented by Prof. A. I. Virtanen, University of Helsingfors, Finland.

Plants may generate some of the oxygen their own roots use, said Prof. W. A. Cannon, Stanford University.

Seeds kept under water for 23 years were found to be still alive by Prof. W. E. Davis, Kansas State Agricultural College.

Plants given initial light doses of X-rays are rendered resistant to later heavier rayings,

Prof. C. A. Shull, University of Chicago, reported.

Plant cells resist the invasion of parasites by producing compounds related to carbolic acid, Dr. Jean Dufrénoy, French plant pathologist, declared.

A method of measuring the rate of sap flow in trees by warming it at one point and then timing the arrival of the warmed sap at another was devised by Prof. Bruno Huber, Darmstadt Technical University, Germany.

Some "coral" islands are predominantly the work of lime-secreting seaweeds, Dr. M. A. Howe, New York Botanical Garden, stated.

"Hybrid vigor" does not affect all hereditary characters in the offspring of a cross uniformly, F. A. Coffman, U. S. Department of Agriculture, reported.

A cream-fleshed potato, hybrid between the ordinary white potato and a yellow species from Peru, was reported by the U. S. Department of Agriculture.

The Smithsonian Institution developed apparatus for growing plants in light limited to narrow spectral bands of about 250 Angstroms.

Chemistry

The world's heaviest water, containing 99.9 per cent. of the heavy isotope (mass two) of hydrogen (deuterium) was made by Prof. Gilbert N. Lewis, University of California.

Electrolytic separation of heavy hydrogen (deuterium) and the manufacture of heavy water made with it was undertaken in several American laboratories and the properties of compounds containing the heavy isotope were determined.

Concentration of heavy water out of ordinary water by distillation and adsorption was accomplished by Drs. E. W. Washburn and Edgar R. Smith, U. S. Bureau of Standards.

Heavy water was found in salt deposits

formed in now extinct stagnant seas and in the Dead Sea and Great Salt Lake, through analyses made by Dr. E. W. Washburn and associates, U. S. Bureau of Standards.

Heavy water (containing deuterium instead of ordinary hydrogen) prevents the sprouting of seeds, experiments by Prof. Gilbert N. Lewis, University of California, upon tobacco seeds demonstrated.

Heavy water (92 per cent. of its hydrogen deuterium) kills tadpoles, guppy fish and worms, Prof. W. W. Swingle, Princeton University, found.

Protium was the name suggested for the atom of ordinary hydrogen of mass one to distinguish it from double weight or heavy hydrogen of mass two which was christened deuterium.

A non-poisonous electroplating solution containing disodium diaquodioxalatocuprate, sodium sulphate and boric acid was developed by Dr. Colin G. Fink and Chaak Y. Wong, Columbia University, to replace the cyanide bath now commonly used for copper plating of steel.

Two new isotopes of mercury with atomic weights 197 and 203 were discovered by Prof. F. W. Aston, Cambridge University, England.

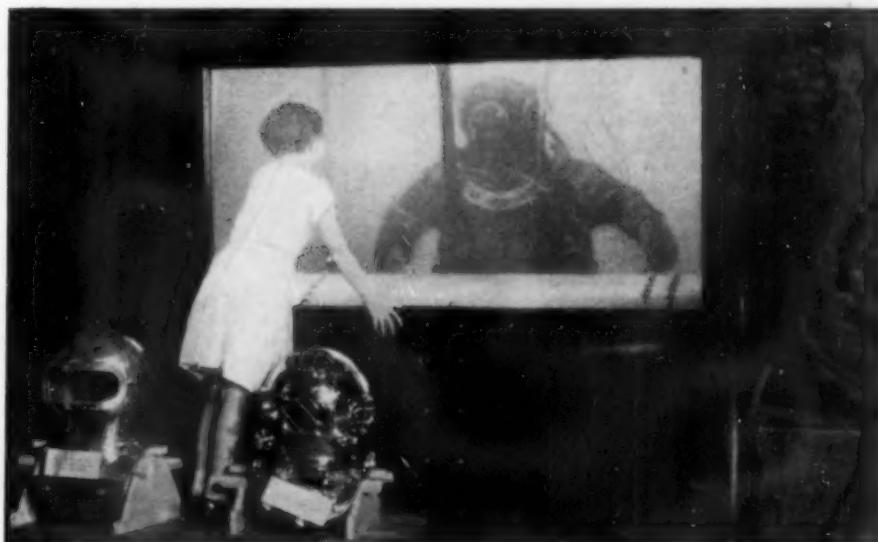
King Tut's purple surface films on gold were duplicated by Prof. R. W. Wood, Johns Hopkins University, and proved to be due to the presence of iron in the gold.

Maleic acid, made as a synthetic compound, will keep edible fats and oils from becoming rancid, Dr. G. R. Greenbank, U. S. Department of Agriculture, discovered.

The new quantum mechanics of physics was applied to activation energies between atoms by Dr. Henry Eyring, Princeton University, resulting in predictions verified by experiment.

An improved oil viscosimeter was devised by Eugene Willihnganz, Pennsylvania State College.

The method of using an electric current to remove salt crusts from antique metal ob-



FLAME UNDER WATER

A diver cuts metal with flame under water and explains his work by microphone to the young observer who looks on through a heavy glass window. This is typical of the "action" exhibits at the Museum of Science and Industry, which opened in Chicago. The museum also contains a full-size coal mine.

Lincoln Electric

jects was applied by Dr. Colin G. Fink to antique Greek pottery vases.

Tricalcium phosphate prevents sugar and salt from caking, H. V. Moss and associates, Provident Chemical Works, St. Louis, reported.

Sweet potato starch is a satisfactory sizing for cotton yarn and may become a valuable commercial raw material, F. H. Thurber, U. S. Bureau of Chemistry and Soils, found.

A new type of sulfur recovered from coke-oven gas by liquid purification is an effective fungicide, insecticide and soil conditioner, it was found by Vincent Sauchelli, Koppers Research Corporation, Pittsburgh.

Light weight aluminum foil sheets separated by air spaces of about $\frac{1}{4}$ inch are extremely good for heat insulation, it was reported by Ralph B. Mason, Aluminum Company of America.

A new method of producing solid carbon dioxide (dry ice) from gas mixtures containing only 10 per cent. or less of the carbon dioxide was reported by Dr. Frank E. Germann, University of Colorado.

A new fermentation to produce butylene glycol from surplus farm products was reported by Prof. Ellis I. Fulmer, L. M. Christensen and A. R. Kendall, Iowa State College.

Stone was made artificially by processes probably duplicating those of nature, Prof. H. C. Peffer, R. L. Harrison and R. Norris Shreve, of Lafayette, Ind., reported.

Diazodinitrophenol may be used effectively to initiate the detonation of high explosives such as dynamite or TNT, L. V. Clark, U. S. Bureau of Mines, found.

A new selenium insecticide for the control of the red spider was reported by C. B. Gnadinger, McLaughlin Gormley King Company, Minneapolis.

A new process for canning tomato juice, insuring the quick removal of oxygen, preserves the vitamin C content, E. F. Kohman, of the National Canners Association, and associates at Columbia University, found.

A new variety of vinyl resin was applied to the making of a multitude of common articles from false teeth to wall panels, it was reported by J. G. Davidson and H. B. McClure, of the Carbide and Carbon Chemicals Corporation and Mellon Institute of Industrial Research.

A revision of the Pure Food and Drugs Act which includes within its scope cosmetics and applies to advertising as well as labels was prepared by the U. S. Department of Agriculture for submission to Congress.

Acetamide, made from acetic acid and ammonia, has a wider range of solvent power than any other known substance, Prof. O. F. Stafford, University of Oregon, demonstrated.

A new test for lead, consisting of the redening of a greenish solution of the aniline dye, diphenyl-thio-carbazone, was developed by H. J. Wichman, U. S. Department of Agriculture.

Mining of sulfur under water making available large deposits under lakes and swamps in Louisiana was perfected by Lawrence O'Donnell, Louisiana chemist.

Growth-stimulating "pantothenic" acid was found in many different kinds of plants and animals and was concentrated by Dr. Roger J. Williams and Carl M. Lyman, Oregon State College.

Hair and feathers are like rubber in their

ultimate mechanical structure, Prof. W. T. Astbury of Leeds University discovered.

American-grown rubber from the guayule shrub was given commercial tests in automobile tires and tubes.

A process for producing phosphoric acid of high purity economically from phosphate rock was perfected by Henry W. Easterwood, Nashville, Tenn., chemist.

Sound vibrations far above the audible pitch coagulate proteins, crack vegetable oils, break down ethyl acetate to produce acetic acid and decompose starch to produce glucose, it was demonstrated by Dr. Earl W. Flosdorff and Dr. Leslie A. Chambers, University of Pennsylvania, carrying on previous research pioneered by others.

Sugar and starch are broken down into simpler compounds by ultra-sonic waves, Prof. A. Szent-Györgyi, Hungarian chemist, discovered.

A new synthetic resin made from coal was developed by Dr. Hanz Fischer, O. Horn and H. Küster, German chemists.

A chemically treated cloth which keeps tarnish off silverware wrapped in it was developed by Dr. Grinnell Jones, Harvard chemist.

Leather that needs no dressing and only a little rubbing to keep it polished was developed at the Mellon Institute of Industrial Research.

Work on the International Critical Tables was completed by the publication of a comprehensive subject index.

Paper was made commercially from young Southern pine under the direction of Dr. Charles H. Herty and regular editions of nine Georgia newspapers were printed on it.

A mercury-vapor detector, about three times as sensitive as previous types, operating if there is one part mercury vapor in 100,000,000 parts of atmosphere, was produced by the General Electric Company.

Engineering

The "Rex" of the Italian Line won transatlantic speed laurels by crossing from Gibraltar to Ambrose Light off New York, 3,181 miles in 4 days, 13 hours and 58 minutes.

Sir Malcolm Campbell made a new world's automobile speed record of 272.108 miles an hour at Daytona Beach, Florida.

A new world's speed record for diesel powered automobiles was made by Capt. G. E. T. Eyston at Brooklands track, England, traveling 102.86 miles per hour over a measured mile and 103.25 miles per hour over a kilometer.

The world's largest dry-dock, capable of accommodating a vessel of 100,000 tons if such a ship should be built, was completed at Southampton, England.

The French merchant vessel *Atlantique*, world's twelfth largest ship, was burned.

Actual construction of the world's largest suspension bridge across the Golden Gate at San Francisco was begun.

Rifle bullets that speed a mile a second and which are squeezed down a tenth of an inch of their diameter as they pass through the rifle bore were investigated by the U. S. Army after invention by H. Gerlich, American-born German citizen now resident in England.

Stainless invar steel, combining rust resist-

ance with small temperature expansion, was invented by Dr. Kōtarō Honda, Japanese scientist.

Auditory perspective in the electrical reproduction of music and other sounds was developed by Bell Telephone Laboratories and demonstrated through a concert by the Philadelphia Symphony Orchestra.

A radio range beacon improvement that allows the aviator to determine his direction from four different signals sent in the four directions was developed by F. W. Dunmore, U. S. Bureau of Standards.

A new type of alternating current electric motor for variable speeds which is synchronous without commutator and with vacuum tube control was invented by Dr. E. F. W. Alexanderson, General Electric consulting engineer.

A new electric watch timer utilizing a constant frequency current and making possible watch regulation in ten minutes instead of ten days was developed by Bell Telephone Laboratories.

A servo-mechanism machine that controls another machine with alertness, speed and accuracy was developed at the Massachusetts Institute of Technology for operating calculating machines.

A photographic camera-projector which copies onto motion picture film newspaper pages for file purposes was perfected commercially.

Photoelectric cell control devices were applied to sorting beans, opening doors in hospitals, restaurants and mines, and a multitude of other uses.

A camera lens of relative aperture F. 0.85, about fifty times the speed of ordinary camera lenses, was developed in Germany.

A three-color photographic process using cellophane sheets was developed by R. M. Reeve, U. S. Army Medical Museum.

The Hoover committee on social trends made a massive factual inquiry which illuminated particularly the part that science is playing in civilization.

The world's tallest radio tower, 878 feet, was erected in Nashville, Tenn.

Rubber was combined with textiles to make a stretchy yarn for use in clothing and elsewhere.

The first practical use of aluminum alloy in bridge construction occurred when it was used to reconstruct the floor of a Pittsburgh bridge.

The planned development of the Tennessee Valley region was authorized by Congress and begun by the Tennessee Valley Authority.

The utilization of the Van de Graaff high voltage static electric generator for practical use in connection with the Tennessee Valley project was suggested.

The Engineering Foundation issued a final report on its arch dam investigation.

A sodium-vapor highway lamp of 10,000 lumens was developed by the General Electric Company.

A 2,000,000-volt lightning generator, was built by General Electric for the testing of transformers.

Construction was started at Schenectady, N. Y., on two waterwheel generators for Boulder Dam, greater in capacity and size than any previously constructed.

An inductor telephone system for communication between the head and rear ends

of long freight trains, between nearby trains, or between trains and wayside points, was announced by General Electric.

Highly permeable cobalt steel was developed by Westinghouse.

Highly magnetic "M.K." steel containing aluminum was developed by Prof. Tokuichi Mishima, Tokyo University.

Preliminary operation of mercury-vapor turbines of 20,000 kilowatts capacity was started at Kearny, N. J., and Schenectady.

New designs of fans giving increased air volume for a given power input with quiet operation were produced by General Electric.

A 35,000 horsepower diesel engine plant, containing five 7,000 horsepower diesels, the largest in the U. S., was put in operation at Vernon, Calif.

The application of carrier current telephony to long toll telephone cables was successfully demonstrated by a 25-mile trial installation near Morristown, N. J.

Multiparty toll service or toll conference was made available throughout the United States to many telephone stations.

The longest direct cable circuit in the world, 1850 miles from New York City to Dallas, Texas, was established.

A 5700-foot vehicular tunnel, running under Boston harbor to connect Boston and East Boston, neared completion.

Passenger train service on the Pennsylvania Railroad from New York to Paoli, Pa., and Wilmington, Dela., was changed from steam to electric operation, thus speeding to completion the greatest railway electrification project.

The largest single-shaft steam turbine with a capacity of 165,000 kilowatts or 221,265 horsepower is being built by Westinghouse for Philadelphia Electric Co.

The fastest elevator, operating at 1,400 feet per minute, was put in service by Westinghouse in a 69-story office building of Rockefeller Center, New York.

The S. S. Washington, length 705 feet, displacement 30,500 tons, which with her sister ship the S. S. Manhattan is the largest merchant ship built in American yards, was put into North Atlantic service on May 10.

A revolution in rail transportation approaches as light weight, streamlined trains are operated at maintained speeds greater than those of the fastest heavy trains.

The country's largest radio station, 500-kilowatt W8XO, being built at Mason, Ohio, for experimental use by the Crosley Co., neared completion.

General

Scientific research in the U. S. Government service suffered from a reduction of funds and universities were forced to reduce heavily their budgets for scientific research.

A Science Advisory Board was appointed by President Roosevelt to act under the jurisdiction of the National Academy of Sciences and the National Research Council to appoint committees to deal with the scientific problems of the government service.

Leading foreign and American scientists joined with Science Service in its conference on the diffusion of scientific knowledge which was a part of the June meeting of the American Association for the Advancement of Science in Chicago.

Chicago's Century of Progress Exposition



THE EARTH SHOOK UNDER CALIFORNIA

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was especially distinguished for scientific exhibits, not alone in the Hall of Science, but in many electrical, astronomical, and even archaeological displays.

Many Jewish scientists, among them Prof. Albert Einstein, were forced to leave Germany when Hitler came into power.

A total of 1,343 doctor's degrees in the sciences were granted in the U. S. during 1933 of which by far the greatest number were in chemistry, a survey made by Dr. C. J. West and Miss Callie Hull of the National Research Council revealed.

A Society for Research in Child Development was organized with the aid of the National Research Council's Committee on Child Development, on June 24.

Geology and Geography

Great damage was done in Long Beach, Calif., and surrounding towns by an earthquake on March 10; the shock, however, was characterized as "not a major one" by seismologists.

Earthquakes caused loss of life in Japan (March), in China (August), and Italy (September), caused a terrific shock under Baffin Bay, disturbed many other regions, especially the Aleutian Islands, the west coast of South America, Japan, the South Sea Islands—a total of 36 "earth-shakers"—quakes severe enough to record themselves on distant seismographs.

Twenty tropical storms came into American waters, establishing an all-time record; the worst previous season recorded was 1887, with 16 storms.

A typhoon in Japan caused the death of about 2,000 fishermen and the loss of 1,000 small boats.

A tidal wave was successfully and accurately predicted by seismologists in Hawaii, on the basis of earthquake traces recorded on their instruments.

Tornadoes were unusually destructive during spring and early summer.

Floods occurred during the spring, on the

Ohio and Lower Mississippi rivers and in some of the streams of the Southeast.

Disastrous floods occurred in the valley of the Yellow River, in China.

Volcanic eruptions were recorded from Mauna Loa, Vesuvius, Llaima in South America, and Izalco in Central America.

Far-reaching reorganization of the U. S. Weather Bureau was recommended in a report by a special committee of the Science Advisory Board.

A comprehensive program of soil erosion control was undertaken by the U. S. Department of Agriculture, with funds supplied by the Public Works Administration.

A new record for cold weather in the U. S. was established in Yellowstone National Park on Feb. 9, when a temperature of 66 degrees below zero Fahrenheit was reached.

The detection of a 23-year cycle in weather was announced by Dr. C. G. Abbot, secretary of the Smithsonian Institution, with the hope that it can be applied eventually to the making of forecasts of temperature and precipitation for all parts of the world several years in advance.

Indications that seasonal temperatures in the U. S. have been slowly growing warmer during the past 50 years were found in a statistical study by J. B. Kincer, U. S. Weather Bureau.

Severe autumnal dust storms occurred in the West.

A new method of locating thunderstorms in a few seconds, combining the use of radio and oscillograph, was worked out in England by R. A. Watson Watt.

Pearly clouds were observed in the stratosphere, from 15 to 19 miles above the earth, and also at 50-mile altitudes, where clouds seldom have been seen before.

Advances toward long-range weather forecasting through the use of the 23-year sunspot cycle were described by Dr. C. G. Abbot of the Smithsonian Institution.

Variations in high and low pressure areas

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in earth's atmosphere are caused by variations in sun's radiation, H. H. Clayton, of Canton, Mass., concluded.

Indications that Europe and America vary their distance apart by as much as 65 feet in a day were obtained through observations using radio and accurate clocks in the private laboratory of Alfred L. Loomis at Tuxedo Park, N. Y.

Meteor Crater in Arizona, hitherto believed to be only a few thousand years old, was estimated to be of Ice Age date, and 40,000 to 75,000 years old, by Prof. Eliot Blackwelder of Stanford University.

Famous Nisqually Glacier in Mount Rainier National Park was damaged by having its snout cut off by a stream of water.

The skeleton of a baby mastodon, found in the La Brea asphalt pits, was mounted in the Los Angeles Museum.

Estimation of geological time by the use of helium gas held captive in rocks was made more reliable.

Estimates of the ages of various hot springs deposits in Yellowstone National Park on the basis of their radium content were made by Prof. Herman Schlundt, University of Missouri.

The making of limy soil in the bottom of a lake through the precipitation of calcium salts by bacterial action was described by Prof. W. H. Twenhofel and associates of the University of Wisconsin.

An important find of mammalian fossils was made in Nebraska by an expedition of the University of California.

Fossil remains of exceedingly primitive primates were found in the Badlands of South Dakota by a Princeton University expedition, and in California by scientists of the California Institute of Technology.

The bones of a giant ground sloth were found near Mexico City.

Botanical distributions of past geologic ages do not support the Wegener "continental drift" hypothesis, Prof. Ludwig Diels of Berlin University declared.

The discovery of frozen carbon dioxide at a depth of 2,800 feet was reported from Poland.

Quartz veins, which may contain precious metals, can now be located by an earth-conductivity method devised by Sherwin F. Kelly of New York.

A method for exploiting residual oil in played-out wells by underground distillation and cracking was developed in the U. S. S. R. by A. B. Scheinman.

The second International Polar Year, in which all northern nations cooperated in research in meteorology, geophysics, etc., was brought to a successful conclusion.

The Sixteenth International Geological Congress was held in Washington, D. C., July 22 to 29.

British-American agreement on the names of many minerals was reached at a conference held in Washington, D. C.

Antarctic exploration was renewed by expeditions under Byrd, Ellsworth, and Riiser-Larsen.

An aerial survey of a region about Greenland and Baffin Island was conducted by Colonel and Mrs. Charles A. Lindbergh in the course of their flight to Europe, Africa and South America.

A five-year field program of studies in Pi-

oneer Settlement was considered by a Canadian Pioneer Problems Committee.

Expeditions were conducted in Greenland under the leadership of Louise A. Boyd (under the auspices of the American Geographical Society), of Lauge Koch of Denmark, and of Knud Rasmussen.

A series of expeditions into the Arctic was conducted by Russian scientists.

A two-year survey of magnetic deviation in the Amazon and Orinoco basins was concluded by Earl Hanson of the Carnegie Institution of Washington.

An expedition into Central Asia was carried out by Sven Hedin; one of its purposes was the re-tracing of old caravan routes, with the possibility in mind of their use by modern transport means.

An expedition to northern India and western Tibet was conducted for Yale University by Dr. Hellmut de Terra.

An expedition to Greenland was sponsored by the University of Michigan and Pan-American Airways.

An Oxford-Cambridge Arctic expedition, with base in Spitzbergen, studied polar ice.

Mt. Everest was flown over and photographed from the air, by a British airplane expedition.

Medicine

A leading subject of medical research during the year was the pituitary gland; evidence that it produces hormones affecting growth, sexual activity, sugar utilization, milk production, and the thyroid and adrenal glands was presented and extraction of some of these hormones accomplished by investigators at McGill University, the University of California, University of Chicago, and the Rockefeller Institute for Medical Research.

The history of the functioning of an individual's pituitary gland throughout his life with all that tells of the individual's health and physical and mental development can be read in changes in his skull that may be seen in X-ray photographs, Dr. Hector Mortimer of Boston reported.

First known antidote for poisonous bichloride of mercury, formaldehydesulfoxylate, was discovered by Dr. S. M. Rosenthal, U. S. Public Health Service.

Protective "vaccination" against pneumonia similar to smallpox vaccination may be possible as a result of the discovery by Prof. Arthur F. Coca, Cornell University Medical College, that pneumonia attacks may be warded off by hypodermic injections of the poison produced by the pneumonia germ.

A widespread outbreak of amebic dysentery, traced to food handlers in two Chicago hotels, was reported in the fall; a number of fatalities due to mistaken diagnosis showed that physicians in the North need to be on the watch for this so-called tropical disease.

A movement to prevent danger to the public health resulting from unsanitary food handling was started in New York City by a committee of public health experts.

An epidemic of encephalitis, said to be the worst in the history of the United States, occurred in St. Louis and vicinity in late summer and early fall.

A concerted attack by scientists of the vicinity, of the U. S. Army and U. S. Public Health Service and of various other institu-



BITE BECOMES UNNECESSARY

It is no longer necessary for infected Anopheles mosquitoes to bite paresis patients in the malaria treatment. Dr. Bruce Mayne of the U. S. Public Health Service devised a method of using salivary glands from the insects and thereby saved the government money and increased the efficiency of the treatment.

tions, including tests on convict volunteers, showed that encephalitis is undoubtedly due to a virus and is not carried by mosquitoes, that the disease can be transmitted to mice and that encephalitis patients develop immune bodies in their blood which give resistance to the disease.

Evidence strongly suggesting that a rabbit tick is the agent that has carried Rocky Mountain spotted fever across the continent was reported by Dr. R. R. Parker, U. S. Public Health Service.

A severe outbreak of plague was reported from Manchuria early in the fall.

A widespread but mild influenza epidemic occurred during the last weeks of 1932 and the first month of 1933.

With the admission of Texas to the death registration area, deaths are now recorded for the whole United States for the first time.

Seventy years was predicted as the expectation of life for future average Americans by Drs. Louis I. Dublin and Alfred J. Lotka, Metropolitan Life Insurance Co.

The causative virus of infantile paralysis travels from the nose to brain in the substance of the olfactory nerve cells whose branches lie exposed on the surface of the nasal mucous membrane, Dr. Simon Flexner, Rockefeller Institute, found.

Mortality from diabetes is increasing throughout the world and in practically all instances the increase is limited to women during and after the menopausal ages, Metropolitan Life Insurance Co. statistical analysis revealed.

One type of arthritis (hypertrophic or degenerative) results from the "wear and tear" of increasing age and from repeated injury to the joints, Drs. G. A. Bennett and Walter Bauer of Harvard Medical School found.

One of the most remarkable feats in surgery was the removal of an entire lung from a three-year-old child suffering from cancer of the lung; the operation performed by Dr. William F. Rienhoff, Jr., Johns Hopkins Hospital, is only the second such ever performed and the first attempted on a child;

the child is now well and living normally.

First surgical removal of an entire lung was performed on an adult patient in April by Drs. Evarts A. Graham and J. J. Singer of Washington University Medical School, St. Louis.

Removal of the normal thyroid gland is a new method used by a group of Boston physicians and surgeons for relieving congestive heart failure and angina pectoris.

The severe pain of angina pectoris, heart disease, was relieved in six cases by cutting nerves, Dr. James C. White, Massachusetts General Hospital, reported.

Removal of tumors of the pancreas and of as much as seven-eighths of that organ itself was done by Dr. Evarts A. Graham of St. Louis to relieve a newly-discovered disease just the opposite of diabetes and due to overproduction of insulin and featured by epileptic-like attacks, mental symptoms, excessive hunger and weakness.

For the first time an operation was performed on a patient who was being kept alive in a respirator or "artificial lung"; the operation was performed at the Long Island College Hospital, L. I., N. Y., and the patient survived.

From the vital cortex of the adrenal glands Drs. Arthur Grollman and W. M. Firor, Johns Hopkins Medical School, extracted a crystalline substance so potent as to be considered probably the pure hormone.

A tentative chemical name for the adrenal cortex hormone and progress toward its laboratory synthesis were reported by Dr. E. C. Kendall and associates at the Mayo Clinic.

Evidence that the adrenal cortex has an influence on regulation of salt and water in the body similar to that of insulin on sugar was found by Dr. R. L. Zwemer, Columbia University.

Maintaining the normal volume of circulating blood was declared by Drs. W. W. Swingle, J. J. Pfiffner, and H. M. Vars, P. A. Bott and W. M. Parkins of Princeton University to be the vital function of the adrenal cortex.

Research of Drs. Frank A. Hartman, J. E. Lockwood and K. A. Brownell of the Uni-

versity of Buffalo showed that the adrenal glands appear to be concerned with vitamin utilization and milk production.

Progress in glandular treatment embraced successful treatment of seven cases of growth retardment verging on dwarfism by extract of growth-stimulating hormone of pituitary gland; relief from symptoms of premature old age in five women following removal of sex organs by treatment with theelin; and suggestion that Addison's disease may be treated more efficiently by the new adrenal-stimulating hormone of the pituitary gland instead of by giving adrenal cortex hormone.

Successful treatment of a bacterial disease (gonococcal vaginitis) by theelin, newly-crystallized female sex hormone, was announced by Dr. Robert Lewis of New Haven, Conn.

Nest-making, an "instinctive" activity of female rabbits, has been artificially provoked in them by injection of a commercial drug containing an active principle from the glands of pregnant women, Esther Bogen Tietz of Cincinnati reported.

The nature of the changes in the microscopic structure of the kidneys in certain types of nephritis was observed for the first time by Dr. W. G. MacCallum, Johns Hopkins Medical School.

Victims of myasthenia gravis, a fatal disease characterized by general weakness, have been given new health and strength by two drugs, glycine and ephedrine, it was reported at the Mayo Clinic.

Dinitro-ortho-cresol and dinitrophenol were found to be powerful metabolic stimulants and weight-reducing medicines but several fatalities caused physicians to warn against careless use of dinitrophenol.

A close chemical relation between a female sex hormone, oestrin, and two of the most powerful known cancer-producing substances, two coal-tar compounds, was observed by Dr. J. W. Cook and Prof. E. C. Dodds, British scientists, who also produced in the laboratory a chemical compound having considerable oestrogenic action.

A reducing substance was discovered in cancer tissue by Dr. Leslie J. Harris of the Cambridge, England, Nutritional Laboratory; significance of the discovery lying in the fact that increase of reducing action is one of the most important characteristics of cancer tissue.

A substance capable of inhibiting the growth of certain forms of cancer cells has been obtained from chicken tumor extracts and from some normal tissues (placenta and embryo skin) was reported by Dr. J. B. Murphy, Rockefeller Institute.

Good results of treatment of certain cancerous diseases with continuous low-voltage doses of X-rays over the entire body were reported by Drs. Lloyd F. Craver and William S. MacComb, Memorial Hospital, New York City.

Cancer treatment by adjusting the content of various minerals in the blood is not justified on the basis of present knowledge, studies on the role of sodium, potassium, calcium and magnesium in cancer, made by Dr. M. J. Shear, U. S. Public Health Service, at Harvard Medical School, showed.

Successful treatment of bone cancer by colloidal arsenic was reported by Drs. A. C. Hendrick and E. F. Burton of Toronto.

A substance produced by the female sex glands is being used by Dr. H. Beckwith

Whitehouse of Birmingham, England, to treat a precancerous condition of the breasts on the theory that the sex hormone slows up the activity of the pituitary gland, faulty function of which is considered by Dr. Whitehouse to be the cause of the breast condition.

An 800,000 volt X-ray machine, the most powerful ever put to practical use, was installed at Mercy Hospital, Chicago, for treatment of cancer.

Liability to cancer as such is not inherited; length of life and susceptibility to certain irritants are the only hereditary factors that can influence the development of cancer, studies of Drs. M. R. Curtis, W. F. Dunning and F. D. Bullock of Columbia University were reported to have shown.

The difference between cancer susceptibility and cancer insusceptibility involves one gene, Maud Slye of the Sprague Memorial Institute and the University of Chicago reported.

Experiments supporting the view that cholesterol prepares the soil for the growth of cancer by acting as an accumulator of light were reported by Dr. A. H. Roffo, Buenos Aires.

The cancer-producing constituent of coal-tar was found to be 1,2-benzopyrene by Drs. J. W. Cook, I. Hieger and C. Hewett of the London Cancer Hospital (Free) Research Institute.

New knowledge of the rare and puzzling

disease, hyperparathyroidism, was gained through the courage of a patient which enabled medical scientists of Boston to discover, after seven operations, the cause of the disease in a mediastinal tumor of the parathyroid glands, the first such tumor ever found in that place.

Breakdown of the phosphocreatine mechanism of the body with resulting excessive excretion of creatine from the body is the basis for the muscular weakness of Graves' disease and of another condition, progressive muscular dystrophy, Drs. E. Shorr, H. B. Richardson and H. G. Wolff of Cornell Medical School and New York Hospital reported.

Death from a diet deficient in vitamins, minerals or other vital food factors is not simply a case of starvation, as previously thought, but may be due to other factors, such as faulty use of fats, which is the cause of death in magnesium deprivation, Drs. E. V. McCollum, H. D. Kruse and Elsa Orent, Johns Hopkins School of Hygiene, found.

Crystals of apparently pure vitamin B₁, preventive of the Oriental disease beri-beri and other nerve disorders, were obtained by Drs. Atherton Seidell and M. I. Smith, U. S. National Institute of Health.

Scurvy-preventing vitamin C was prepared synthetically by Dr. T. Reichstein and associates at the Polytechnic Institute of Zürich, who obtained pure crystals of L-ascorbic acid, considered to be identical with vitamin C.

A case of scurvy in man was cured by injections of ascorbic acid, formerly called hexuronic acid and considered identical with scurvy-preventing vitamin C, Dr. Poul Schultz, resident physician of the Copenhagen Municipal Hospital, reported.

Connection between diet and cataract of eye was reported by several investigators: Prof. H. K. Muller, University of Basel, Switzerland, reported experiments showing that lack of vitamin C might be a cause of cataract; Drs. Paul L. Day, William C. Langston and K. W. Cosgrove, Little Rock, Ark., and Dr. Arthur M. Yudkin, New Haven, reported studies showing that lack of vitamin G may be a cause of cataract.

Definite evidence of an anti-growth factor in the parathyroid glands was found by Drs. C. J. Eastland, N. Evers and J. H. Thompson of London.

Resistance to disease is an hereditary trait like color of eyes, hair or skin, studies with mice at the Rockefeller Institute for Medical Research showed.

Research indicating that alcoholic cirrhosis may be due not to alcohol from beverages but to phosphorous from the iron and steel beverage containers was reported by Dr. Frank Mallory of Boston.

A premium of 10 per cent. in the price of safety X-ray film of cellulose acetate was eliminated by the Eastman Kodak Company as a contribution to the campaign for safety in hospitals.

The exact method by which blow-fly maggots act to clean and heal stubborn wounds was finally discovered by a group of Pittsburgh scientists who observed that the maggots throw out into the wound a secretion having weak digestive action which liquifies the dead and decaying matter.

Shape and size of the brain is often determined by the skull, rather than the reverse, Prof. C. U. Ariens Kappers, Central Dutch Institute for Brain Research, Amsterdam, found.

Vaccination against smallpox was successfully carried out with virus grown on hen-eggs instead of with calf-lymph virus by a method developed by Prof. E. W. Goodpasture and associates of Vanderbilt University Medical School.

A "spreading factor" produced in living tissue by invading germs and making it easier for the germs to invade new territory in the tissues was discovered by investigators at the Rockefeller Institute for Medical Research.

Talkie films of patients were found an aid in identifying the nervous disease, disseminated sclerosis, by Miss F. Janvrin working at a London hospital for nervous diseases.

Microcolonies of leprosy bacilli were grown on artificial medium outside the body of man or other animal, it was claimed by Drs. Earl B. McKinley and Elizabeth Verder of George Washington University Medical School.

A serum for protection against tularemia or rabbit fever which apparently reduced the severity of the disease in 72 patients was developed by Dr. Lee Foshay and Prof. W. B. Wherry, University of Cincinnati.

Skill with the fingers, major postural adjustments of the body, and regulation of such involuntary actions as sweating and bloodvessel adjustment were traced to the premotor area of the brain by Prof. J. F. Fulton of Yale University.

Evidence that centers responsible for blood pressure control, heart rate control, breathing control and sweating, shivering, hiccupping, yawning and other functions of the autonomic nervous system are probably located in the diencephalon or interbrain was found by Prof. Wilder Penfield, McGill University.

Serious deformities of face and teeth may result from idiosyncrasy or sensitivity to certain foods, Dr. Ralph Bowen of Oklahoma City found.

Heat or cold or physical effort may cause headaches, asthma, skin eruptions and other symptoms of allergy in sensitive persons, Dr. W. W. Duke of Kansas City reported. European physicians reported cases of cold allergy which suggest that people with idiosyncrasy to cold are in danger of drowning from bathing in cold water.

Thorium dioxide, new chemical used to diagnose spleen and liver diseases, was found by Drs. Ernest A. Pohle and Gordon Ritchie of the University of Wisconsin to produce such injurious changes in the liver and bone marrow of animals that they recommended restriction of its use to incurable cases.

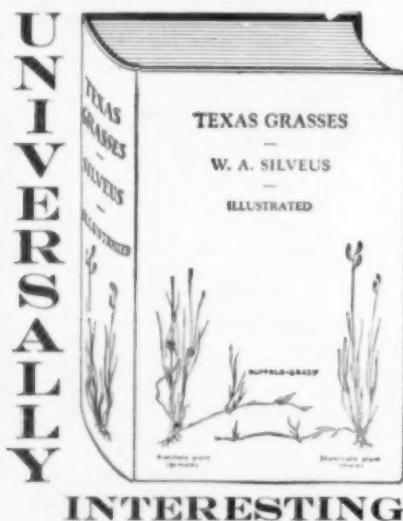
A new remedy for poisonous potassium cyanide has been developed by Drs. K. K. Chen and G. H. A. Clowes and Charles L. Rose of the Lilly Research Laboratories, the remedy being made up of sodium thiosulfate and amyl or sodium nitrite.

Successful vaccination of over 100 children against whooping cough was reported by Dr. Louis Sauer of Evanston, Ill.

Use of a magnet to isolate certain tissue cells after feeding them iron was reported by Drs. Peyton Rous and J. W. Beard, Rockefeller Institute.

Transposed organs are the result of developmental accidents, Dr. Harold Cummins of Tulane University concluded from a study of the direction of the hair whorl and of palm prints in these rare cases.

Amount of pepsin in stomach juice of patients suffering from stomach ulcer was found to be a good index of the progress



INTERESTING

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and outcome of the disease by Drs. Arnold E. Osterberg and F. R. Vanzant, Mayo Clinic.

Bacteria survived freezing for weeks in liquid helium at a temperature of about 450 degrees below zero F. and were able to multiply after being thawed out.

Foot-and-mouth disease virus may invade the bodies of cattle through the nostrils, experiments at the Rockefeller Institute for Medical Research seemed to show.

That the yellow fever mosquito can transmit a serious epidemic disease of horses and mules, Kansas-Nebraska horse plague, was reported by Maj. R. A. Kelser, U. S. Army Medical School.

Bone conduction as an aid to hearing for deafened persons attained practical application in America through the development of several portable devices for individual use and one permanent one for group use.

Cyclopropane, gas anesthetic discovered by Prof. V. E. Henderson, University of Toronto, was used for the first time on a series of patients by Drs. J. A. Stiles and W. B. Neff at the University of Wisconsin.

A device for the removal of plaster casts, working as smoothly as a modern can-opener, was produced in the General Electric research laboratory.

Patents and Inventions

Patents granted during 1933 indicated scientific and technological progress along the following lines:

Devices for picking up sound waves from only one direction and a localized area in that direction.

Binaural sound recording and reproduction to give "perspective" to reproduced sound.

Automatic means for making sound effects subsidiary to dialogue in broadcasting.

Application of dial system to long distance calls through use of automatic switching systems.

In mechanical telegraphy, use of vacuum tubes to replace mechanical distributors, making possible speedier transmission.

In television, an electric arc with electromagnetic means for controlling rate of motion, permitting a high rate of scanning and rapid change of rate.

Automatic volume control to reduce fading effects in radio receivers.

A way to utilize both the positive and negative halves of the radio waves for simultaneous transmission of two independent messages.

A vertical broadcasting antenna designed to attain better radiation in horizontal directions than with the horizontal type generally used.

Radio sets adapted for use with either A. C. or D. C. current.

In the regulation of dynamo electric machinery use of reactors, tubes, and similar devices, to replace mechanical moving parts.

Improvements in calculating machines making possible their automatic operation when once a problem was set up.

Chemical and electrical treatments for the rapid aging of whiskey and other alcoholic beverages.

Sheet steel evaporators replacing copper coils in electric refrigerators to provide a more rugged construction puncture-proof against ice picks.

Improvements in pneumatic brakes permitting the operation of 150-car freight trains instead of the former maximum of 100 cars.

Important progress in the forming of alloys, particularly hard carbide alloys for

tools and copper aluminum magnesium base alloys tending to be lighter, stronger, with increased malleability and less subject to corrosion.

In the art of curing cement, application of high frequency vibrations to the concrete mix, allowing a mix of extremely low water content to be used, causing additional strength.

Physics

The lowest temperature ever produced and measured, eighty-five thousandths of a degree above the absolute zero, which is the point at which all atomic motion would cease, was achieved at the University of Leyden by the adiabatic demagnetization of paramagnetic salts.

The existence of the positive electron discovered by Dr. Carl D. Anderson, California Institute of Technology, in 1932, was confirmed by Dr. P. M. S. Blackett and G. Occhialini, Cambridge University, England.

A positive electron was christened "positron" by its discoverer, Dr. Carl D. Anderson, California Institute of Technology.

The conversion of energy into mass was demonstrated in the bombardment of lithium by helium nuclei.

Deuton was the label given to the nucleus of the heavy or double weight hydrogen atom of mass two (deuterium) discovered in 1931.

Cosmic space between the galaxies is filled with high energy positrons which constitute an appreciable fraction of the total mass of the universe, Dr. P. M. S. Blackett, Cambridge, England, suggested.

Light creates matter in the form of a pair of electrons, one positive and one negative, and this miracle is performed only in the neighborhood of an atomic nucleus, it was suggested by Dr. P. M. S. Blackett and G. Occhialini, Cambridge University.

Deutons or heavy hydrogen nuclei, accelerated to the record speed equivalent to 3,000,000 volts in Prof. E. O. Lawrence's whirligig atom gun at University of California, were flung at targets with the result that atoms were smashed with large release of energy.

"Positive" X-rays were produced by impinging positively charged ions upon a metal target by Drs. W. M. Coates and E. O. Lawrence, University of California.

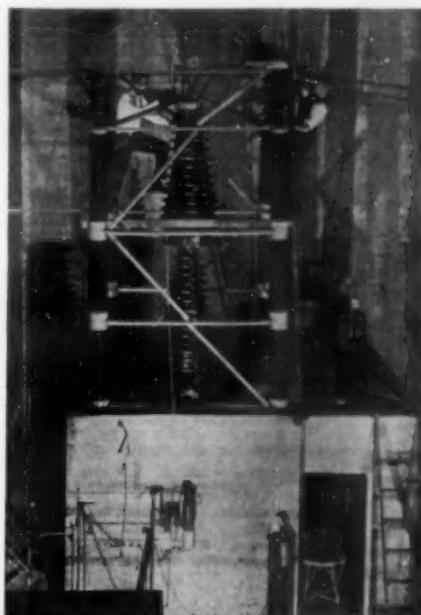
For the first time a proton was knocked out of matter artificially when heavy weight hydrogen nuclei were used to bombard carbon by Prof. E. O. Lawrence, University of California.

Boron was smashed with the release of atomic energy when bombarded with hydrogen nuclei by Drs. J. D. Cockcroft and E. T. S. Walton, Cambridge, England.

Neon was smashed by speeding neutrons in experiments by Drs. D. M. Gans, H. W. Newsom and Prof. W. D. Harkins, University of Chicago.

Lithium atoms were disintegrated by bombardment with protons at as low as 13,000 volts by Drs. H. Rausch von Traubenberg, E. Eckardt and R. Gebauer, at Kiel. Transmutation (helium from paraffin by thorium radiation bombardment) was for the first time chemically detected by Prof. Fritz Paneth and P. L. Günther, University of Königsberg, Germany.

Deutons, the nuclei of heavy weight hydrogen, are more effective in releasing neutrons from beryllium and lithium than helium nuclei, H. R. Crane, Dr. C. C. Lauritsen



ATTACKING THE ATOM

Operated by skilled physicists at California Institute of Technology, this tube has yielded important knowledge about the hearts of atoms. It was the first to furnish neutrons without requiring radioactive matter, making its own alpha rays out of ordinary helium atoms. Then, with the help of heavy hydrogen atoms, deutons, it increased the output of neutrons a thousand times.

and Dr. A. Soltan, California Institute of Technology, demonstrated.

The neutron is not a combination of electron and proton but an elementary particle, Dr. Franz N. D. Kuriie of Yale concluded.

Cosmic ray experiments by Dr. R. A. Millikan, California Institute of Technology, and Dr. A. H. Compton, University of Chicago, can be interpreted by assuming that both photons and particle rays, some of them perhaps positrons, are present in the incoming beam, these two investigators agreed.

Cosmic rays are probably the nuclei of atoms of ordinary matter, positively charged by the action of starlight on interstellar gas, and accelerated in some cosmic or possibly terrestrial electric field, Dr. Thomas H. Johnson, Franklin Institute, concluded from observations of cosmic ray intensities in Panama, Peru, Mexico, and this country.

Cosmic rays are streams of particles or corpuscles, not electro-magnetic waves like light, X-rays or radium's gamma rays, Prof. Bruno Rossi, Italian physicist, concluded.

Cosmic rays are the chief source of energy in the universe and from 30 to 300 times more energy is shooting through celestial space in the form of cosmic rays than in all other radiant energy forms combined, Drs. I. S. Bowen, Robert A. Millikan and H. V. Neher, California Institute of Technology, concluded.

Cosmic rays that are four times as penetrating as those hitherto known were demonstrated by Prof. W. Kolbörster, in Germany.

Energy supplied by cosmic rays would raise the temperature of a body in interstellar space to 3.1 degrees over the absolute zero

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Quarterly Journal of Speech: "Shows that the authors mean to build the structure of their book upon a broad deep foundation of scholarship."

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of temperature, Prof. E. Regener, Stuttgart, Germany, stated.

A Milky Way static or radio impulse that seems to come from the vicinity of the heart of the Milky Way was discovered by Karl G. Jansky, Bell Telephone Laboratories.

X-rays are generated by the passage of a swiftly moving electrified particle through gas, Dr. Gordon L. Locher, Franklin Institute, discovered.

The 10,000,000 volt direct current electrostatic generator devised by Dr. Robert J. Van de Graaff, Massachusetts Institute of Technology, was completed and demonstrated at Round Hill, Massachusetts.

Success in the generation of high voltage direct current by the Van de Graaff electrostatic generator may make possible a revolution in the commercial generation, distribution, and utilization of electricity.

Thin films of the alkali metals possess the unique property of being transparent to ultraviolet light but opaque to visible light, Prof. R. W. Wood, Johns Hopkins University, demonstrated.

Powder films of silver, gold, and several other metals, transparent to infrared or heat rays but opaque to visible light, were prepared by Prof. A. H. Pfund, Johns Hopkins University.

The existence of an intermediate electric "roof" or electrically charged radio reflecting layer of the upper atmosphere was confirmed by researches of J. P. Schafer and W. M. Goodall, Bell Telephone Laboratories.

Ultra-short radio waves two meters in length were passed through mountains and curved around the surfaces of the earth to receiving stations below the horizon by Guglielmo Marconi.

Undamped three-centimeter radio waves were generated by Prof. G. W. Potapenko, California Institute of Technology, and used in high-frequency magnetic and electric experiments.

The iconoscope, a television apparatus without scanning disk or other moving parts, consisting of multiple light-sensitive photo-cells played upon by a stream of electrons, was developed by Dr. V. K. Zworykin, R. C. A. Victor Company.

Ozone is abundant in the atmospheric layer eight miles above sea level, researches in Switzerland and England showed.

Prof. Max Born, theoretical physicist of the University of Göttingen, Germany, developed an electromagnetic field theory which combined with quantum dynamics leads to reconciliation between the classical view points of an imaginarily small electron and one with a finite size.

Excessive sound absorption in air of desert humidity found due to collisions between oxygen and water molecules by Prof. Vern O. Knudsen, University of California at Los Angeles, and Dr. H. O. Kneser, University of Marburg, Germany.

Neutrons were artificially produced by disintegrating beryllium with artificial alpha particles at the California Institute of Technology.

The uncertainty principle was extended to the electrical field of a particle by Abbé Georges Lemaitre, University of Louvain.

A portable roentgenometer of about fountain pen size was invented by Prof. C. C. Lauritsen, California Institute of Technology, for the protection of scientists working with radium and X-rays.

A low-temperature laboratory capable of keeping up a continuous supply of a liter and

a half of liquid helium was put in operation at the California Institute of Technology.

Prof. Albert Einstein published on the new quantum mechanics under the title "Semivectors and spinors" and on the Dirac equation.

Gamma or X-rays produce their devastating effects in animal body by raising an individual molecule to higher temperature (freeing an electron), not by great energy transfer, it was theorized by Prof. Friedrich Desauer, Frankfurt-am-Main.

An uncertainty theory extension, that faint light may be incapable of forming a distinct image of a very small area, was tested by Prof. John Q. Stewart, Princeton University and Dr. A. M. Skellert, Bell Telephone Laboratories.

Permanent-magnet alloys of many times the strength of the commonly used tungsten or chrome magnet steels were developed in the General Electric Research Laboratory.

The smallest practical X-ray unit, having both the Coolidge tube and the high-tension transformer immersed in oil, and rated at 58,000 volts and 10 milliamperes, was announced by the General Electric X-ray Corporation.

The world's largest spectroscope, a monochromator, was built by the General Electric's Incandescent Lamp Department, Cleveland.

Evidence that the fine structure constant and the e/m relation from the Zeeman effect are not precisely accurate was offered by Drs. W. V. Houston, Y. M. Hsieh, and L. E. Kinsler, California Institute of Technology.

The mass of the neutron was computed from experiments: Dr. R. M. Langer, California Institute of Technology, arriving at 1.0062 from disintegration of lithium by deutons by Lord Rutherford, Dr. M. L. E. Oliphant, and Dr. B. B. Kinsey, Cambridge University; compared with 1.0067 advocated by Dr. J. Chadwick, Cambridge University, the neutron's discoverer; 1.012 determined by the Joliot's of Paris; and 1.0006 announced by Prof. E. O. Lawrence, University of California, from deuton experiments.

Very small vacuum tubes for operation with conventional circuits at wavelengths as short as thirty centimeters were developed by B. J. Thompson and G. M. Rose.

Psychology and Psychiatry

The auditory nerve cannot transmit highest audible frequencies and hence the frequency theory of hearing cannot apply to frequencies over 2800, Drs. H. Davis, A. Forbes, and A. J. Derbyshire, Harvard Medical School, reported.

Katydid ears respond to frequencies ranging from 800 cycles to 45,000 (human upper limit, 20,000 cycles), it was found by Drs. E. G. Wever and C. W. Bray of Princeton.

Evidence of organization of brain corresponding to the space-time organization of experience was found by Dr. George Kreezer, Vineland Training School.

The human brain attains full size and the child attains adult mental capacity (microscopic evidence) by the age of six years, it was reported by Drs. Y. T. Loo and T. Wingate Todd, Western Reserve University.

A 3-year-old mountain gorilla brain, weight 466.6 grams (human brain 1,100 grams, adult coast gorilla, 379.3 grams) with



PROVING THAT HE CAN SEE

Part of a demonstration that infants are not blind at birth and can see objects when three hours old.

highly developed cerebrum, was studied by Dr. C. J. Connolly, Catholic University of America.

A new index to personality (insensible weight loss rate, i.e., from breath vapor and skin moisture) was reported on by Drs. W. R. Miles and Catharine C. Miles, Yale Institute of Human Relations.

The visual field corresponding to the eye's blind spot is not completely devoid of light sensation, Dr. C. R. Garvey, Yale, found since bright lights in it are seen by irradiation from the optic disk to sensitive areas of the eye.

The human eyeball does not pivot exactly on its center but rotates on a shifting pivot which moves forward considerably when the eye executes vertical movements; and this mechanism influences our judgments of space, reading of instrument scales, etc., Dr. Walter R. Miles, Yale Institute of Human Relations, found.

Fingertips are sensitive to vibration rates as high as 8,192 double vibrations per second (2,700 previously considered the upper limit) by Dr. Robert H. Gault, Northwestern University.

Pitch and intensity of sounds were found distinguished better in bright illumination than in dark, by Dr. George W. Hartmann, Pennsylvania State College.

The color-blind are superior in distinguishing shades of light and dark, and so especially fitted for engraving and X-ray work, it was found by Drs. Leandro M. Tocantins and Harold W. Jones, Jefferson Medical College, Philadelphia.

White U. S. men are more subject to color blindness than other races (Indians, Negroes, Mexicans and Jews) tested by Dr. Thomas R. Garth, University of Denver.

Negro children displayed superior ability to follow rhythm in beating time with a drum in tests conducted by Dorothy M. Muzey, Southern Illinois State Teachers College.

Human infants are not blind at birth but were found to see objects when three hours old by Dr. W. C. Beasley, Johns Hopkins University.

Newborns can distinguish between dim and moderately bright illumination, increasing activity in the stronger light, tests showed LaBerta Weiss, Iowa Child Welfare Research Station.

New-born babies can detect odors, it was found by Dorothy R. Disher, Ohio State University.

Noise produces activity in newborn infants, but musical notes are quieting, it was found by Dr. Karl C. Pratt, Central State Teachers College, Mt. Pleasant, Mich.

Loss of support does not arouse instinctive fear in infants provided they are not roughly

handled, it was found by Dr. W. C. Beasley, Johns Hopkins University.

Training enabled an infant to roller-skate, swim, and climb steep inclines, but gave no advantage in sitting alone, walking erect, or outgrowing the grasping and embracing reflexes, it was shown by tests on twins by Dr. Myrtle B. McGraw, Babies Hospital, New York.

Chimpanzees can use "money" to obtain food and to buy privileges Dr. John B. Wolfe, Laboratories of Comparative Psycho-biology, Yale University found.

The American voter, although not supporting the Socialist party, is inclining more toward socialistic doctrines, Prof. Edward S. Robinson, Yale Institute of Human Relations, found from a survey of 8,419 persons of five social classes.

The "public" attitude of a group may be opposed to the "private" attitudes of its members, it was found by Dr. Richard L. Schanck, Syracuse University.

A punishment loses effectiveness if followed soon by a rewarded act, for the reward effect spreads to "stamp in" even punished behavior, it was found by Dr. Edward L. Thorndike, Columbia University.

The aged find particular difficulty in learning material that reverses previous learning, it was found by Dr. Floyd L. Ruch, University of Illinois.

Intelligence increases with training in improved home environment, it was found by Dr. F. N. Freeman, University of Chicago.

To detect when a dream occurs in the sleep of deaf-mute persons, a sensitive galvanometer was used by Dr. Louis W. Max, New York University.

Manic-depressive and dementia praecox psychoses are not two separate mental diseases, but five related syndromes, it was indicated by a new statistical technique of Dr. Thomas Verner Moore, Catholic University of America.

The mental disease schizophrenia is characterized by upset physiological equilibrium and low metabolic rate, blood pressure, and pulse rate with high waste fluid output, Dr. R. G. Hoskins, Memorial Foundation for Neuro-Endocrine Research, Harvard Medical School, found.

Diets with faulty salt balance or deficient in vitamin B do not break down mental ability, rat experiments showed Dr. Martin F. Fritz, Iowa State College.

One type of mental disease, constitutional schizophrenia, begins insidious development in early infancy, it was observed by Dr. Jacob Kasanin, Rhode Island State Hospital for Mental Disease, and Dr. Karl M. Bowman, Harvard Medical School.

Epilepsy is not inherited, but vulnerability to it may be, study of 1,000 cases revealed

to Dr. Calvert Stein, Monson State Hospital.

"Pale freckles," were found a new diagnostic sign of epiloia, a type of feeble-mindedness, by Dr. Alexander N. Bronfenbrenner, Letchworth Village.

Specially trained mental defectives usually become self-supporting adults, it was shown by follow-up of 122 defectives by Dr. Ruth E. Fairbank, Johns Hopkins Hospital.

A new clinic providing segregation and optimum conditions for the rapid improvement of recoverable mental cases was opened at Boston State Hospital, Boston, Mass.

Rewards and Recognitions

The 1933 Nobel Prize in Medicine was awarded to Dr. Thomas Hunt Morgan, California Institute of Technology, for his fundamental researches in genetics.

The 1933 Nobel Prize in physics was shared by Prof. E. Schrödinger, of Berlin, now at Oxford, and Prof. P. A. M. Dirac, of Cambridge, as a reward for their new forms of atomic theory.

The 1932 Nobel Prize in Physics was awarded this year to Prof. W. Heisenberg, of Leipzig, for his development of quantum mechanics and the resultant discovery of the allotropic forms of hydrogen.

Walter H. Aldridge, president of the Texas Gulf Sulphur Co., received the Saunders Medal for distinguished achievement in mining engineering from the American Society of Mining and Metallurgical Engineers.

The gold medal of the Paul Ehrlich Foundation of Germany was awarded to Dr. Oswald T. Avery, Rockefeller Institute for Medical Research.

Dr. Wilder D. Bancroft, Cornell, was awarded the William H. Nichols medal of the New York Section of the American Chemical Society for his research on colloid chemistry.

Dr. F. G. Banting, Toronto discoverer of insulin, was elected honorary fellow of the Royal College of Surgeons.

Prof. Heinrich Barkhausen, of the Technical College of Saxony, was awarded the Morris Liebmann Memorial Prize of the Institute of Radio Engineers for his work on oscillating circuits.

Dr. Francis Arthur Bather, of Wimbledon, England, was awarded the Mary Clark Thompson Medal of the National Academy of Sciences for his distinguished services in the fields of paleontology.

The hundredth anniversary of the publication of Dr. William Beaumont's work on gastric digestion was celebrated at the New York Academy of Medicine on October 5.

Dr. Earl D. Bond, Philadelphia psychiatrist, received the \$10,000 Philadelphia award established by Edward W. Bok.

Dr. Isaiah Bowman, director of the Amer-

ican Geographical Society of New York, was elected chairman of the National Research Council.

Prof. Percy W. Bridgman, physicist of Harvard University, was awarded the Comstock prize given every five years by the National Academy of Sciences for notable investigations in electricity, magnetism, or radiant energy.

Dr. Lyman J. Briggs was made director of the National Bureau of Standards, following service as acting director, assistant director and chief of the division of mechanics and sound. He succeeds the late Dr. George K. Burgess.

A "depression" award for effective use of chemical engineering was given to the Carbide and Carbon Chemical Corporation by the Journal, Chemical and Metallurgical Engineering.

The late Dr. John J. Carty was awarded posthumously the new John J. Carty Medal and Award for the Advancement of Science by the National Academy of Sciences.

A testimonial dinner was tendered Dr. J. McKeen Cattell in recognition of the long service to science, particularly his pioneer work in psychology.

The Elliott Cresson Medal of the Franklin Institute, Philadelphia, was awarded to Senor Juan de la Cierva, of London, for his original conceptions resulting in the creation and development of the autogiro.

Dr. Frank Conrad, assistant chief engineer of the Westinghouse Electric and Manufacturing Company, was honored with the John Scott Medal by the City of Philadelphia for his achievements in radio.

Dr. George Oliver Curme, Jr., research director of the Carbide and Carbon Chemicals Corporation was awarded the 1933 Chandler Medal for his synthesis and large-scale production of many aliphatic chemical compounds.

Watson Davis was made director of Science Service, the institution for the popularization of science.

Dr. Albert Defant, of the Institute for Oceanography, Berlin, was awarded the Alexander Agassiz Medal of the National Academy of Sciences for his studies on atmospheric and oceanic circulation and notable contributions to theoretical oceanography.

Dr. George F. Dick, of the University of Chicago, and his wife, Dr. Gladys H. Dick, of the John McCormick Institute for Infectious Diseases, were awarded the Cameron Prize by the Senatus Academicus of the University of Edinburgh, for their work on the etiology and treatment of scarlet fever.

James Orr Elton, manager of the International Smelting Co., was awarded the James Douglas Medal of the American Institute of Mining and Metallurgical Engineers.

The American Association for the Advancement of Science's \$1,000 prize was

awarded to Dr. Henry Eyring, Princeton, who applied quantum mechanics to chemical problems.

Dr. David Fairchild, pioneer plant explorer for the U. S. Department of Agriculture, was awarded the Public Welfare Medal by the National Academy of Sciences for his lifelong work of bringing to the United States useful and ornamental trees and plants. It will be presented next year.

Sir John Ambrose Fleming, British consulting engineer, received the Institute of Radio Engineers' Medal of Honor for his early work in applying physical and engineering principles to radio.

The late John Ripley Freeman, of Providence, R. I., was given a posthumous award of the John Fritz Medal as an "engineer preeminent in the fields of hydraulics and water supply, fire insurance economics and analysis of earthquake effects."

Sir Richard Glazebrook was awarded the Royal Aeronautical Society's gold medal, its highest award.

Commander Jerome Clarke Hunsaker, vice-president of the Goodyear-Zeppelin Corporation, was honored with the Daniel Guggenheim medal.

Daniel Cowan Jackling, of San Francisco, received the John Fritz Medal.

Dr. Harold Spencer Jones, of the Royal Observatory at the Cape of Good Hope, was appointed Astronomer Royal and head of the Royal Observatory at Greenwich.

The Leslie Dana Gold Medal for service in conserving human eyesight, was presented to Dr. William H. Luedde, of the St. Louis University School of Medicine.

Prof. Richard S. Lull, Yale, was appointed editor of the famous American Journal of Science.

Prof. G. R. Minot, Harvard Medical College, discoverer of the liver treatment for pernicious anemia, was awarded the Moxon Gold Medal of the Royal College of Physicians (England).

The one hundredth anniversary of the birth of Alfred Nobel was celebrated throughout the world on December 18, and in New York American Nobel Prize winners were invited to a dinner in his honor.

Dr. Thomas B. Nolan, U. S. Geological Survey, was awarded the Spendiaroff prize of the International Geological Congress.

The Perkin Medal was awarded to George Oenslager, research chemist of the B. F. Goodrich Company, for his work in developing nitrogenous organic accelerators for vulcanization of rubber and contributions to development of carbon black tread for tires.

Dr. William H. Park, of New York City, was given the Public Welfare Medal of the National Academy of Sciences for his work in the New York City Department of Health both in research and in disease prevention.

Ford L. Prescott, U. S. Army Air Corps,

was honored with the Manly Memorial Medal Award of the Society of Automotive Engineers.

Dr. Milton J. Rosenau, of Harvard University, was awarded the Sedgwick Memorial Honor for Distinguished Service in Public Health of the American Public Health Association.

Dr. Paul Sabatier, dean of the faculty of sciences of Toulouse University, Toulouse, France, was awarded a Franklin Medal by the Franklin Institute, Philadelphia, for his contributions to chemistry, particularly his discovery of the catalytic activity of finely divided common metals.

Dr. Bela Schick, Mount Sinai Hospital, New York, originator of the Schick test for diphtheria susceptibility, was awarded the gold medal of the Phi Lambda Kappa, national medical fraternity.

Dr. V. M. Slipher, director of Lowell Observatory, Flagstaff, Ariz., received the gold medal of the Royal Astronomical Society.

Dr. V. M. Slipher, of the Lowell Observatory, was awarded the Henry Draper Medal of the National Academy of Sciences in recognition of his spectroscopic researches.

Dr. Theobald Smith, Rockefeller Institute, pioneer American microbe hunter, was awarded the Copley medal of the Royal Society.

Dr. Frank H. Spedding, 30-year-old chemist of the University of California was awarded the Langmuir prize of the American Chemical Society for his low temperature research on the structure of matter.

Dr. Elihu Thomson, pioneer in the field of electricity, was honored on the occasion of his 80th birthday by a special scientific program and dinner at the Massachusetts Institute of Technology.

James G. Vail, vice president and chemical director of the Philadelphia Quartz Company, was awarded the new Chemical Industry Medal of the American Section of the Society of Chemical Industry.

Prof. H. B. Vickery, Connecticut Agricultural Experiment Station, was awarded the Stephen Hales Prize of the American Society of Plant Physiologists.

Eugene Vidal, director of aeronautics for the U. S. Department of Commerce, was appointed to the National Advisory Committee for Aeronautics to succeed Dr. William F. Duran, professor emeritus of Stanford University.

The Symons Gold Medal was awarded by the Royal Meteorological Society to Sir Gilbert T. Walker, Imperial College of Science and Technology, England.

Edward P. Warner, editor of Aviation, was given the Wright Brothers Medal Award by the Society of Automotive Engineers.

Dr. Edward Weston, developer of electrical measuring instruments, was awarded the Lammé Medal of the American Institute of Electrical Engineers.

Dr. Richard Willstätter, of München, Germany, authority on the chemistry of chlorophyll, was awarded the Willard Gibbs Medal of the American Chemical Society.

Dr. R. W. Wood, Johns Hopkins University, was awarded the Frederic Ives medal by the Optical Society of America, and he was also elected honorary fellow of the Physical Society of London.

Dr. Orville Wright, pioneer student of airplane design, received a Franklin Medal from the Franklin Institute, Philadelphia, for the investigations carried out by him and his brother Wilbur.

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